REMARKS

Claims 1 to 3 and 5 to 27 remain pending in the application. Applicant notes with appreciation the withdrawal of the previous objection to claim 23. Claim 9 has been amended in this amendment to be dependent on claim 1. Withdrawal of the objection to claim 9 is therefore respectfully requested.

Claims 1 to 3 and 5 to 27 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite. This rejection is respectfully traversed for the reasons explained below.

Claim 1 was rejected as being indefinite because it was unclear as to how the image is selected. In making this rejection, the Examiner quotes various phrases from the claim. Specifically, the Examiner quotes from lines 13–15, ". . . selecting, as the comparison image close to the reference image, the comparison image having the smallest minimum distance", then quotes line 20, saying that it refers back to "the generated comparison *images*" and finally from lines 26–31, the image comparing means "identifies whether a match exists between any of the generated comparison images and of the reference image." The Examiner concludes that "It is unclear as to how many comparison images are passed from the 'comparison image generating means', lines 7–15, to the remaining elements of the claim since it appears as though lines in 13–15 that only one comparison image is selected." It is believed that the problem is that the selected phrases have been read out of context, and in so doing, the Examiner has confused the recitation of the singular "image" with the plural "images". Claim 1 recites, *inter alia*, the following:

> "comparison image generating means for generating, for the reference image for the at least one object, a comparison image close to the reference image, said generating including projecting the three-dimensional data onto a two-dimensional image in accordance *with each of the plurality of pose candidates to generate a plurality of comparison images* and calculating, for each of the plurality of

comparison images, the minimum distance between the comparison image and the reference image and selecting, as the comparison image close to the reference image, the comparison image having the smallest minimum distance;" (emphasis added).

In other words, the comparison image generating means generates a comparison image for each of the plurality of pose candidates, thereby generating a plurality of comparison images.

The Examiner made similar comments with respect to independent claims 10 and 19, but when read as whole, these claims, like claim 1, are also clear and unambiguous. To assist the Examiner in his reconsideration of the claims, claims 1 and 10 are read on the drawings and specification as follows:

1. An image comparison system **[Figure 8]** comprising:

means for inputting **[10]** three-dimensional data of an object;

reference image storing means **[30]** for storing a reference image of at least one reference object;

pose candidate deciding means **[20]** for generating a plurality of pose candidates;

comparison image generating means **[40]** for generating, for the reference image for the at least one object, a comparison image close to the reference image, said generating including projecting the three-dimensional data onto a two-dimensional image in accordance with each of the plurality of pose candidates to generate a plurality of comparison images and calculating, for each of the plurality of comparison images, the minimum distance between the comparison image and the reference image and selecting, as the comparison image close to the reference image, the comparison image having the smallest minimum distance;

reference correction coefficient storing means **[65]** for storing a correction coefficient corresponding to the reference image;

image comparing means **[55]** for determining one of a minimum distance value and a maximum similarity degree between the reference image and the generated comparison images; and

correcting means **[60]** for correcting, based on the correction coefficient, one of the minimum distance value and the maximum similarity degree determined by the image comparing means,

wherein the image comparing means performs a comparison between the reference image and each of the generated comparison images on the

basis of one of the minimum distance value and the maximum similarity degree corrected by the correcting means and, based on a result of the comparison, identifies whether a match exists between any of the generated comparison images and of the reference image.

The description of Figure 8 is found in the specification beginning on page 20, line 27, and continuing to page 23, line 2, (paragraphs [0070] – [0074]), which describes each of the elements recited in the claim. The overall operation of the system shown in Figure 8 is described in the specification with reference to Figures 8 and 9 beginning on page 23, line3, and continuing to page 28, line 2, (paragraphs [0075] – [0083]). Claim 10 is directed to the image comparison method illustrated in Figure 9:

> 10. An image comparison method for identifying a match of an object to a stored reference image of at least one object, comprising steps of:
>
> inputting three-dimensional data **[100]** of an object;
>
> generating at least one pose candidate **[110]** as a candidate for pose of the object;
>
> generating, for the reference image of the at least one object, a comparison image **[120]** close to the reference image, said generating including projecting the three-dimensional data onto a two-dimensional image in accordance with each of the plurality of pose candidates to generate a plurality of comparison images and calculating, for each of the plurality of comparison images, the minimum distance **[130]** between the comparison image and the reference image and selecting, as the comparison image close to the reference image, the comparison image having the smallest minimum distance;
>
> storing a correction coefficient corresponding to the reference image;
>
> identifying **[140]** whether a match exists between the generated comparison image and the reference image, said identifying including determining one of a minimum distance value and a maximum similarity degree between the reference image and the generated comparison images; and
>
> correcting, based on the correction coefficient, one of the minimum distance value **[160]** and the maximum similarity degree determined by the identifying step,
>
> wherein the step of identifying whether a match exists includes performing a comparison between the reference image and each of the generated comparison images on the basis of one of the minimum

> distance value and the maximum similarity degree corrected by the correcting step and, based on a result of the comparison, identifying whether a match exists between any of the generated comparison images and of the reference image.

Claim 19 is directed to a computer readable medium and may be read on the specification and drawings similarly to claim 10.

In view of the foregoing explanations, it is respectfully requested that the rejection of the claims as being indefinite be withdrawn.

Claims 1 to 3, 7 to 13, 16 to 22 and 25 to 27 were rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent 6,002,782 to Dionysian in view of U.S. Patent Application Publication 2001/0020946 of Kawakami et al. This rejection is respectfully traversed for the reason that the combination of Dionysian and Kawakami et al. does not show, suggest or otherwise teach the claimed invention.

In making the rejection, the Examiner preferences his comments by stating "With regards to claims 1, 10 and 19, *as best understood by the Examiner*, Dionysian teaches an image comparison system, method and program . . ." (emphasis added). The Examiner makes similar statements in connection with his comments on the rest of the claims. It is assumed for purposes of this response, and based on the Examiner's prior rejection of the claims as being indefinite, that he has difficulty in understanding the claims. As has already been demonstrated in response to the rejection under 35 U.S.C. §112, second paragraph, the claims are, in fact, clear and definite, and it can only be concluded that the Examiner's confusion as to what is being claimed has led to his repeated rejection of the claims based in part on the Dionysian patent.

Dionysian discloses a method for recognizing a three-dimensional object, such as a person. According to the Dionysian method, there is first an enrollment phase. In the enrollment phase, a three-dimensional digital model of the surface of the object is stored in a memory. Thereafter, in an access phase, a two-dimensional access image of an unidentified object is acquired by a camera which views the object from a particular direction which is unpredictable. Then, from the stored three-dimensional

model, a two-dimensional image of the model is generated as seen from a selectable viewing direction which approximates the particular direction from which the unidentified object is viewed in the access image. Then a correlation is performed between the access image of the unidentified object and the image that was generated from the three-dimensional model; and the unidentified object is identified as the object if this correlation exceeds a predetermined threshold. According to this method, the three-dimensional model which is accessed from memory is first transformed such that its X-axis coincides with the viewing direction of the two-dimensional access image of an unidentified object. Then, from the transformed three-dimensional model, a "new" two-dimensional image in the Y–Z plane as viewed parallel to the X-axis is generated, and it is this "new" two-dimensional image that is correlated with the two-dimensional access image of an unidentified object. This process is a very computationally intense process.

In contrast, the image comparison system according to the present invention is characterized by comprising input means for input three-dimensional data of an object, reference image storing means for storing a reference image of at least one object, pose candidate generating means for generating a pose candidate as a candidate for pose of the object, comparison image generating means for generating a comparison image close to the reference image while projecting the three-dimensional data onto a two-dimensional image in accordance with the pose candidate, and image comparing means for performing comparison on the basis of one of a distance value and a similarity degree between the reference image and the comparison image. The image comparison method according to the present invention is characterized by comprising the steps of inputting three-dimensional data of an object, generating a pose candidate as a candidate for pose of the object, generating a comparison image close to a reference image while projecting the three-dimensional data onto a two-dimensional image in accordance with the pose candidate, and performing comparison on the basis of one of a distance value and a similarity degree between the reference image and the comparison image.

Note that the system and method claimed do not require transforming the reference image accessed from memory. The first effect of the present invention is that comparison and search can be performed at high accuracy even when reference images of each object are captured under different conditions such as pose and illumination. This is so because three-dimensional data of an object is measured, a comparison image matching the image sensing conditions such as the pose and illumination of each reference image is generated, and comparison is performed by comparing the comparison image with the reference image. The second effect is that comparison and search can be performed at high accuracy even when no three-dimensional object model of each object can be obtained beforehand, or even when only one or few reference images exist. This is so because three-dimensional data of an object is measured, a comparison image matching the existing reference image is generated, and comparison is performed by comparing the comparison image with the reference image. Moreover, the claimed invention determines minimum distance values, rather than calculating correlation functions. Dionysian fails to teach the features/functions that the Examiner has attributed to it. For example, the portion cited by the Examiner (column 4, lines 29–58) as rendering obvious the limitation "pose candidate deciding means for generating a plurality of pose candidates," actually describes transforming co-ordinate axes, i.e., rotating the "access image" of a person to the same orientation as the "model" image of the person that was previously stored. According to Dionysian, the "model" image, and the orientation at which it was obtained, are stored and retrieved according to the person's assigned personal identification number (PIN).

The Examiner relies on Kawakami et al. to teach a correcting means for correcting one of the minimum distance value and the maximum similarity degree determined by the image comparing means; however, the Examiner has provided no citation to Kawakami et al. to support this. Assuming *arguendo* that Kawakami et al. do teach such a feature, the teaching would be contrary to that of Dionysian since the two types of calculations are entirely different. The Examiner goes on to say that

"Dionysian fails to explicitly teach generating a plurality of pose candidates; reference correction coefficient storing means for storing a correction coefficient, on of the minimum distance value and the maximum similarity degree determined by the image comparing means." The Examiner's use of the adverb "explicitly" is objected to as misleading, suggesting as it does that there may be some inherent or implied teaching in Dionysian of these features when, in fact, that is none. The Examiner goes on to cite page 5, paragraphs [0073] – [0077], page 6, paragraphs [0084] – [0087], and Figure 1, page 6, paragraphs [0080] – [0087], of Kawakami et al. at teaching (1) generating a plurality of pose candidates, (2) a reference correction coefficient storing means, and (3) a correcting means for correcting, based on the correction coefficient, one of the minimum distance value and the maximum similarity degree determined by the image comparing means. However, this is a misinterpretation of what Kawakami et al. teach. First, Kawakami et al. describe a computationally complex pose transform process. Second, the only mention of "coefficient" in Kawakami et al. is to be found in paragraph [0058] relating to what is presumably a matrix "H", but this matrix is not defined. Certainly, there is no mention of reference correction coefficients as specifically claims. Third, the description in paragraphs [0080] – [0087] pertains to Figure 5, not Figure 1, and while the flow diagram illustrates a step of "correct parameters", this is not in any way related to correcting a distance value on the basis of a correction coefficient.

From the foregoing analysis, it is clear that combining Dionysian and Kawakami et al. would not yield the claimed invention. Withdrawal of the rejection is therefore respectfully requested.

Claims 5, 6, 14, 15, 23, and 24 were rejected under 35 U.S.C. §103 as being unpatentable over the patent to Dionysian in view of the Kawakami et al. publication, and further in view of U.S. Patent 6,956,569 to Roy et al. This rejection is respectfully traversed for the reason that the combination of the patent to Dionysian, the Kawakami et al. publication, and the patent to Roy et al. does not show, suggest or otherwise teach the claimed invention.

The combination of Dionysian and Kawakami et al. have been commented above. In making this rejection, the Examiner states that "Dionysian fails to teach a system, method and program further characterized by further comprising reference weighting coefficient storing means for storing a weighting coefficient corresponding to the reference image, said image comparing means comprising calculating means for calculating one of the distance value and the similarity degree between the reference image and the comparison image by using the weighting coefficient corresponding to the reference image." The Examiner relies Roy et al. for a teaching of these features, citing column 6, lines 5 – 26 and lines 34 – 60, column 9, line 64, to column 10, line 58, and column 10, line 41, to column 11, line 12. The only mention of "coefficient" that can be found in Roy et al. is in reference to a "brightness coefficient". Roy et al. does not contemplate a weighting coefficient as claimed. Roy et al. adds nothing to the combination of Dionysian and Kawakami et al. that would make up for the deficiencies already noted and, for that reason, withdrawal of the rejection is respectfully requested.

For the foregoing reasons, it is respectfully requested that the application be reconsidered, that claims 1 to 3 and 5 to 27 be allowed, and that the application be passed to issue.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

A provisional petition is hereby made for any extension of time necessary for the continued pendency during the life of this application. Please charge any fees for such provisional petition and any deficiencies in fees and credit any overpayment of fees to Attorney's Deposit Account No. 50-2041 (Whitham, Curtis, Christofferson & Cook).

Respectfully submitted,

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